SCIENCE

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson N. Y.

SENATORIAL INVESTIGATION OF FOOD ADULTERATION.

DURING the closing session of the last Congress, the Senate authorized the Committee on Manufactures to conduct a recess investigation on the subject of the extent and character of food adulteration in the United States. By reason of expiration of the term of service, only three members of the Senate Committee on Manufactures remained, namely, W. E. Mason, Chairman, of Illinois; W. A. Harris, of Kansas, and G. P. Wetmore, of Rhode Island. Under the terms of the resolution it is not necessary to have a quorum of the Committee, but the Chairman or any member designated by him is empowered to conduct the investigation, procure witnesses and to secure the analyses of suspected samples.

The Committee has already begun its work by holding a two weeks' session in Chicago. Dr. H. W. Wiley, the Chief Chemist of the Department of Agriculture, at the request of the Committee, has been detailed by the Secretary of Agriculture as an expert to attend the examinations and to assist in the work as far as possible.

Much interesting testimony was secured at the meeting in Chicago in regard to the extent and character of food adulteration.

Not only were business men who were engaged in adulteration placed upon the stand, but also some well-known hygienic and scientific experts, among whom may be

mentioned Professor A. B. Prescott and Dr. V. C. Vaughn, from the University of Michigan.

Dr. Wiley was placed first upon the stand, and gave an outline of the character and extent of food adulteration as it has been revealed through the many years of investigation in the Chemical Division of the Department of Agriculture. Manufacturers of 'pure Vermont maple sugar' testified, under oath, that much of the product that they sold contained not more than 25 per cent. of maple sugar or syrup. When asked in regard to the purity of the maple sugar which they bought for mixing purposes they testified that they believed it to be pure, but were by no means certain. Glucose is the usual adulterant for maple syrup, although melted brown sugar is sometimes employed where a thinner product, more nearly resembling maple syrup, is desired. It was testified that when retail dealers desired maple syrup for their customers they specified the price they were willing to pay, and that the mixing was then done according to that price.

Manufacturers of jellies also testified that the cores and skins from cider factories and drying kilns were employed as the base of much of the pure fruit jellies manufactured and sold. Glucose is used as the principal filler in these jellies, and the color and flavor are largely supplied by synthetic products. The quantity of these adulterated goods made is far greater than that of the pure article.

Professor A. S. Mitchell, Chief Chemist of the State Board of Health and Pure Food and Dairy Commissioner of Wisconsin, was a valuable witness before the Committee. He brought with him samples of adulterated goods secured in the State of Wisconsin, and explained in detail the nature of the adulteration as it had been disclosed by his analyses. He described particularly the antiseptics and preservatives which were on the market under various trade names, such as 'freezem' and 'freezine,' and so forth. 'Freezem' was shown to be a dilute solution of formaldehyde, while 'freezine' was composed chiefly of sodium sulphite. The question of the use of preservatives was discussed by the experts before the Committee, and the universal opinion was expressed that they were all unwholesome. Since, however, there are certain articles of food and condiments, such as cider, tomato catsup, etc., which require some preservative in order to prevent fermentation; and inasmuch as it was brought out in the evidence that in the shipment of butter from Australia to English ports the use of boric acid was quite universal and was not objected to by the English customers, and as it was further stated in the evidence that English merchants required that hams sent to England from a distance should be rubbed with boric acid, the experts unanimously agreed that it would not be wise to pass a law prohibiting the use of all preservatives, but that thorough investigation should be made to determine which kinds of preservatives are least objectionable, and that in all cases any article of food, drink or condiment containing a preservative should have that fact plainly stated on the label and the quantity thereof indicated.

It was brought out in the evidence that the oleomargarine law was practically violated in many parts of Chicago. One witness before the Committee went to five grocery stores and asked for creamery butter. In each case he received oleomargarine. In each case the wrapper, which, according to law, should bear the word 'oleomargarine,' plainly visible, was so arranged that the purchaser could not possibly see the word. The plan was to stamp the word 'oleomargarine' near the corner of the wrapper and then to fold the corner of the wrapper over so that the stamp

would be invisible. One of the dealers selling these packages was brought before the Committee and testified that some of the richest people living in Chicago were his customers, buying this substance and knowing that it was oleomargarine, but who desired that the fact of its use by them should be kept secret.

The ethics of coloring butter and oleomargarine was also discussed before the Committee, and it was brought out in evidence that if oleomargarine was colored pink or any other color than butter color its use as butter would be practically destroyed.

Evidence was also given in the matter of making artificial whiskies from cologne spirits, burnt sugar and the ethers of the organic acids, together with the essential oil to give the proper bead. It was developed that the trade in these synthetic drinks was very large, and that the natural products suffer severely in competition.

Much testimony was also given in regard to the adulteration of the ordinary condiments, such as ground pepper, mustard, cinnamon and so forth. It appeared that these bodies were largely mixed with inert matter, so that the purchaser would really get very little of the condiment which he desired. It was shown that ground coffee was mixed largely with chicory and other substances, and that the coffee bean was mixed with an artificial bean or with a certain proportion of the dead or imperfect beans, which were not only useless for flavoring the beverage, but, on the other hand, were bitter and unpalatable.

The session of the Committee in Chicago had for its object the outlining of the scope of the investigation which will be continued during the summer months in other localities of the United States. The final purpose of the Committee is to obtain material on which to base a report in favor of a national pure food and drug bill, having for its object the regulation of traffic in the adulteration of food in the District of Columbia and the Territories and the control of inter-State commerce in adulterated food and drug products.

AMERIND—A DESIGNATION FOR THE ABORIGINAL TRIBES OF THE AMERICAN HEMISPHERE.

A PART of the proceedings of the Anthropological Society of Washington, at a meeting on May 23d last, seem destined to produce permanent influence on ethnologic nomenclature; this part of the proceedings taking the form of a symposium on the name of the native American tribes. The discussion was opened by Colonel F. F. Hilder, of the Bureau of American Ethnology, with a critical account of the origin of the misnomer 'Indian,' applied by Columbus to the American aborigines; he was followed by Major J. W. Powell, who advocated the substitution of the name *Amerind*, recently suggested in a conference with lexicographers. A communication by Dr. O. T. Mason followed, in which the various schemes of ethnologic classification and nomenclature were summarized and discussed. Contributions to the symposium were made also by Dr. Albert S. Gatschet, Dr. Thomas Wilson and Miss Alice C. Fletcher. At the close of the discussion the contributions were summarized (by President McGee) as follows:

1. There is no satisfactory denotive term in use to designate the native American tribes. Most biologists and many ethnologists employ the term 'American'; but this term is inappropriate, in that it connotes, and is commonly used for, the present predominantly Caucasian population. The term 'Indian' is used in popular speech and writing, and to a slight extent in ethnologic literature; but it is seriously objectionable in that it perpetuates an error, and for the further reason that it connotes

and so confuses, distinct peoples. Various descriptive or connotive terms are also in use, such as 'North American savages,' 'Red Men,' etc.; but these designations are often misleading, and never adapted to convenient employment in a denotive way.

2. In most cases the classifications on which current nomenclature are based, and many terms depending on them for definition, are obsolete; and the retention of the unsuitable nomenclature of the past tends to perpetuate misleading classifications.

3. While the name 'Indian' is firmly fixed in American literature and speech, and must long retain its current meaning (at least as a synonym), the need of scientific students for a definite designation is such that any suitable term acceptable to ethnologists may be expected to come into use with considerable rapidity. In this, as in other respects, the body of working specialists forms the court of last appeal; and it cannot be doubted that their decision will eventually be adopted by thinkers along other lines.

4. As the most active students of the native American tribes, it would seem to be incumbent on American ethnologists to propose a general designation for these tribes.

5. In view of these and other considerations, the name *Amerind* is commended to the consideration of American and foreign students of tribes and peoples. The term is an arbitrary compound of the leading syllables of the frequently-used phrase 'American Indian'; it thus carries a connotive or associative element which will serve explicative and mnemonic function in early use, yet must tend to disappear as the name becomes denotive through habitual use.

6. The proposed term carries no implication of classific relation, raises no mooted question concerning the origin or distribution of races, and perpetuates no obsolete idea; so far as the facts and theories of ethnology are concerned, it is purely denotive.

7. The proposed term is sufficiently brief and euphonious for all practical purposes, not only in the English but in the prevailing languages of continental Europe; and it may readily be pluralized in these languages, in accordance with their respective rules, without losing its distinctive sematic character. Moreover, it lends itself readily to adjectival termination in two forms (a desideratum in widely-used ethnologic terms, as experience has shown), viz.: *Amerindian* and *Amerindic*, and is susceptible, also, of adverbial termination, while it can readily be used in the requisite actional form, *Amerindize*, or in relational forms, such as *post-Amerindian*, etc.; the affixes being, of course, modifiable according to the rules of the different languages in which the term may be used.

8. The term is proposed as a designation for all of the aboriginal tribes of the American continent and adjacent islands, including the Eskimo.

The working ethnologists in the Society were practically unanimous in approving the term for tentative adoption, and for commendation to fellow students in this and other countries.

EXPLORING EXPEDITION TO THE MID-PACIFIC OCEAN.

The unusual activity now being exhibited by various European governments in scientific exploration of the seas is soon to be supplemented by the United States, for arrangements are being perfected by the United States Commission of Fish and Fisheries for one of the most important marine scientific expeditions ever undertaken in this country. The association of the name of Professor Alexander Agassiz with the expedition is a guarantee of its high scientific standing, and the employ-

ment of the Fish Commission steamer *Albatross* ensures the proper paraphernalia for marine research.

The objective points of the expedition are certain groups of islands in the middle of the Pacific Ocean, of both sides of the equator, about whose local fauna little is known, and in the waters contiguous to which little or no scientific investigation has been conducted.

The *Albatross* will sail from San Francisco about the middle of August, and proceed directly to Tahiti, in the Society Islands, possibly touching at the Marquesas Islands for coal. On this trip of 3,500 miles, dredging and sounding will be carried on at regular intervals on an almost wholly unexplored section of the sea bottom.

Tahiti will be made the headquarters while the Paumotu Islands are being explored. In this archipelago, which is about 600 miles long, the *Albatross* will pass six or eight weeks, and important scientific discoveries should be made, as the natural history of the region is practically unknown.

After returning to the Society Islands the vessel will go to the Tonga, or Friendly Islands, a distance of about 1,500 miles, where a week or ten days will be spent. Thence the vessel will sail for the Fiji Islands, where a short stay will be made, and thence 1,700 miles to the Marshall Islands, visiting a number of the Ellice Islands and Gilbert Islands on the way. Six or seven weeks will be devoted to the exploration of the Marshall Islands, about whose fauna almost nothing is known.

Between the Marshall Islands and the Hawaiian Islands, and between the latter and San Francisco, a distance of over 4,000 miles, a line of deep-sea dredgings will be run, deep-sea tow-nets being used while the dredging is going on. This work is expected to be one of the most interesting features of the expedition.

The *Albatross* is expected to return to the United States about April 10, 1900, after a voyage of 20,000 miles.

Every effort is being made to thoroughly equip the vessel for deep-sea dredging, trawling and sounding; surface and intermediate towing; shore seining; fishing trials with lines and nets; land collecting, and other branches of the work. The newest apparatus for deep-sea and plankton investigations will be supplied. Special appliances are being constructed for use in the very deep water to be found about some of the islands, and it is expected that the dredge will be hauled at a greater depth than has heretofore been attempted. The *Albatross*, since her return to the Fish Commission by the Navy Department, on the conclusion of the Spanish-American War, has been undergoing extensive repairs and improvements, including the installation of new boilers, the building of an ice-making machine and cold-storage plant, electric fans, etc., and will, on this expedition, more than ever deserve the reputation of being the best equipped vessel in existence for scientific research.

The personnel of the expedition will be as follows: Professor Alexander Agassiz, in charge of the scientific work, accompanied by his son; Lieutenant Commander Jefferson F. Moser, United States Navy, commanding officer of the *Albatross*, in charge of topographical surveys; Dr. H. F. Moore, chief naturalist of the *Albatross*; Mr. Charles H. Townsend, late naturalist of the *Albatross*; Dr. W. McM. Woodworth and Dr. A. G. Mayer, Museum of Comparative Zoölogy, Cambridge, Mass.; Mr. A. B. Alexander, United States Fish Commission, fishery expert; Mr. H. C. Fassett, United States Fish Commission, photographer. The vessel is manned by ten officers and seventy petty officers and enlisted men of the United States Navy.

The Department of State evinces a lively interest in the expedition, and has through

our ambassadors communicated with the British, French and German authorities for the purpose of having the representatives of those governments instructed to accord special privileges to the *Albatross*. The President has cordially approved the assignment of the vessel to this work.

In a recent letter Professor Agassiz refers to his explorations in the Bahamas, the Bermudas, Cuba, Florida, the Fiji Islands, the Australian Great Barrier Reef, the Sandwich Islands, the Bay of Panama, the Galapagos Archipelago and the Gulf of California, and then says:

> The expedition now proposed I consider the most important one I have undertaken since the cruise of the 'Blake' in 1877–80. It covers an area of the Pacific which has not as yet been touched, as nothing is known of the line San Francisco to Tahiti, Tahiti to Fiji, Ellice and Jaluit, and Marshall Islands to Honolulu; and most important results should be obtained with a vessel so admirably fitted for the work as the Albatross. In addition to the deep-sea work, we expect to visit many of the atolls and elevated reefs abounding along our track, and hope to throw additional light on the debatable theory of coral reefs. The proposed Albatross expedition is one which, with fair success, is sure to be creditable to this country. Since the great exploring expedition of Wilkes this government has done but little in the greater field of oceanic exploration as a whole, though the minor expeditions undertaken in connection with the work of the Coast Survey and the Fish Commission have been among the most satisfactory explorations of limited areas of our coast.

It is the intention to have the Fish Commission and the Museum of Comparative Zoölogy jointly publish the reports embodying the results of the expedition.

Hugh M. Smith.
U. S. Commission of Fish and Fisheries.

THE SCIENTIFIC STUDY OF IRRIGATION.

The appropriation for the irrigation investigations in charge of the Office of Experiment Stations, Department of Agriculture, having been increased at the recent session of Congress from $10,000 to $35.000, of which sum $10,000 was made immediately available, these investigations are being further developed and the work in connection with them is being more thoroughly organized. The scope of the investigations has been more accurately defined in the last appropriation act. As there stated, funds are provided "To enable the Secretary of Agriculture to investigate and report upon the laws and institutions relating to irrigation, and upon the use of irrigation waters, with special suggestions of better methods for the utilization of irrigation waters in agriculture than those in common use, and for the preparation, printing and illustration of reports and bulletins on irrigation; and the agricultural experiment stations are hereby authorized and directed to cooperate with the Secretary of Agriculture in carrying out said investigations in such manner and to such extent as may be warranted by a due regard to the varying conditions and needs of the respective States and Territories, and as may be mutually agreed upon."

The first bulletin prepared in connection with these investigations, which has recently been issued, contains a discussion of the irrigation laws which control the diversion and use of water from the Missouri River and its tributaries, by Professor Elwood Mead, including papers on the water laws of Colorado and Nebraska, by the engineers of these States. Other bulletins of a similar character are in preparation.

For the present the investigations on the use of irrigation water will be largely confined to the determination of the actual amount of water used by successful farmers in different parts of the irrigated region on different soils and in the growing of different crops.

A temporary organization for the administration of these investigations has been effected by the appointment of Professor Elwood Mead as irrigation expert in charge,

and headquarters have been established at Cheyenne, Wyoming. It is hoped that some work may be done during the present season in most of the States and Territories west of the Mississippi River in which irrigation is practiced to any considerable extent. Arrangements have also been made to aid the New Jersey experiment stations in continuing their investigations, which have already attracted much favorable attention in the East.

As far as practicable the cooperation of the experiment stations will be sought in these investigations, and it is to be hoped that one result of this work will be that the stations will not only be able to develop their investigations relating to irrigation in the lines in which the Department will work under this appropriation, but also in other important lines involving operations by different divisions of the station. It is believed that, by concentrating their efforts on problems based on the requirements of agriculture under irrigation, the stations in a number of States and Territories may materially enhance their usefulness.

It should be clearly understood that the irrigation investigations of this Department are intended to cover only a limited portion of the field of investigations relating to agriculture under irrigation which the stations and the different divisions of the Department may properly undertake. An effort will be made to mark out a line of work for these investigations which will give them a distinct place between the investigations of the Geological Survey relating to the topography and water supply of the irrigated region, and those of the different branches of the Department and stations which relate to the climate and plants of that region. Aside from the studies of the laws and institutions of communities in which irrigation is practiced, the irrigation investigations will have for their chief object the determination of the economic and profitable utilization of water in agriculture as it is supplied to the farmer through reservoirs, canals and ditches. In these investigations, as in nearly all others relating to the complex science of agriculture, there will be many points of contact with investigations conducted under other auspices, and thus many opportunities for cooperative effort will be presented. With so large a field of operations and so great interests at stake, there will be abundant room for all the agencies now at work for the benefit of agriculture of the irrigated region to fully utilize all the means at their command. Besides the development of the irrigation investigations, the Department will, for example, continue studies of alkali soils, the native and cultivated plants and trees best adapted to the arid regions, and other related questions.

The people of that vast area of our country in which agriculture and the other industries are so largely dependent on the successful practice of irrigation are to be congratulated that attention was more earnestly and successfully drawn to their needs during the recent session of Congress than ever before, and more ample provision than heretofore was made for studying the problems of agriculture in that region, through increased appropriations for the work of the Geological Survey and different branches of the Department of Agriculture.

A. C. TRUE,
Director.

THE INTERNATIONAL CATALOGUE OF SCIENTIFIC LITERATURE.—SECOND CONFERENCE.

II.

IT becoming apparent that no early conclusion would be reached, based on the resolution of Professor Armstrong, it was withdrawn, and Dr. Adler moved "That the registration symbols used in the Cata-

logue be based on a system of letters and numbers, adapted in the case of each branch of science to its individual needs." Professor Darboux proposed the expression 'of letters or of numbers.' Dr. Adler explained his motion by saying that the use of letters and numbers which would furnish the opportunity of alternating gave a greater elasticity to the system than the use of either one by itself.

Chevalier Descamps objected to the terms of the resolution as restricting the Catalogue to the use of letters and numbers as symbols, whereas it might be found desirable to employ other symbols. Professor Armstrong thought that this construction need not be placed on the words, the idea being that letters and numbers were the fundamental symbols.

Professor Darboux said that the real matter to arrive at was a scheme of classification suited to present needs, and of whose durability one might be assured. After some further discussion Dr. Adler made a further explanation as to the object of his resolution. The first Conference had discussed the subject of classification and symbols, and not being able to arrive at any conclusion had referred the matter to the Royal Society. The Society had appointed a committee, which, after long labor, had presented a report, and thus far the Conference had done nothing but criticise it. He did not think it desirable or possible to discuss further detail. The resolution moved was broad and in general terms with the idea that its interpretation and details be left to the persons in whose charge the execution of the Catalogue would actually be. In order, however, to get further advice on the subject he would later on move a provision for an international committee and give the scientific men of the various countries an opportunity to pass on the details of classification.

Professor Klein (Germany) strongly approved of the appointment of an international committee and of special committees in the various countries, and supported the resolution with a suggestion as to verbal modification.

Dr. Heller spoke in recognition of the work of the Royal Society and supported the statement of Professor Klein and others, that the various sciences had different needs. After remarks by Dr. Graf the resolution was slightly amended by inserting the words 'or other symbols' in addition to letters and numbers.

M. Otlet asserted that the lack of uniformity in the system proposed would result in great inconvenience. Professor Darboux thought the whole matter not of great importance and going too much into detail. Professor Armstrong, however, stated that such a resolution was very much desired by the Royal Society, as it would clear the field. The Committee was of the opinion that the different sciences require different treatment, subject to a general uniformity.

Dr. Adler stated that his resolution did not at all require that each science should have a different scheme of classification or registration. He maintained, however, that the arrangement should be from the point of view of the scientific man, and not of the classifier. If they could agree on a single uniform scheme so much the better.

Professor Klein supported this view, holding that it was important to pass on to the next matter relating to the appointment of committees for the study of the schedules.

Chevalier Descamps asserted that the resolution would result in more inconveniences than advantages. He stated that he and his colleagues of the International Office of Bibliography at Brussels were in a peculiar position. Without wishing to disparage the work done in any other country, he would say that they had collected two

million slips and that most of their work was proved by results which were here being ignored.

Dr. Adler reiterated it as his intention that as far as possible, a uniform system of registration be adopted. Chevalier Descamps proposed adding words to this effect, asserting that classification was also a science with its own laws. From this Dr. Adler dissented, stating his view that classification and notation were simply convenient tools for sciences. The resolution was then unanimously agreed to, with the modifications proposed, reading as follows:

"That the registration symbols used in the Catalogue be based on a convenient combined system of letters, numbers or other symbols adapted, in the case of each branch of science, to its individual needs, and in accordance, as far as possible, with a general system of registration."

The second proposition of Dr. Adler was "That the authoritative decisions as to the schedules be intrusted to an International Committee, consisting of the following: Professor Darboux, Professor Klein, Professor Weiss, Dr. S. P. Langley, Professor Korteweg and Dr. Graf, together with three representatives of the Royal Society; that the Committee be instructed to consult with experts in each science and to frame within six months a report, which shall be issued by the Royal Society and incorporated in the decisions of the Conference."

Dr. Brunchorst agreed with the resolution in principle, but stated that the sciences were not equally represented.

Professor Darboux thought that the question raised by this resolution was a central one for the Conference. It was a pity that some practical step of this sort had not been taken at the previous Conference requesting the states to form a sort of embryo of Regional Committees which might have placed themselves in relation with the Royal Society.

Professor Korteweg pointed out that the resolution meant the nomination of a central commission to control, as far as possible, the different projects of classification. This commission need not contain representatives of all sciences, especially as it had the authority to secure the aid of special committees.

Professor Darboux thought it best that the official representatives at the Conference should constitute the local or regional committees of classification.

Dr. Bernoulli thought that the Conference had approached its second important question—that of organization. With regard to the first question—that of classification—he fully agreed with Dr. Darboux that it should be settled by the specialist in each branch of science for his own subject. The central committee proposed by the representative of the United States should have to do only with notation. Switzerland, he said, could not constitute a regional bureau or committee. But to a central committee of this sort he agreed, if it were made representative of the libraries as well as the sciences, and if the Director of the Bibliographical Institute at Brussels were included.

Professor Klein desired to bring the Conference back to the principal point as to how the classification of the schedules was to be made. It had been the intention to hold a conference of scientific men in Berlin for the purpose of arriving at some opinion, but this had been delayed, though the idea was not given up, and the plan of arriving at opinions, at least so far as Germany was concerned, seemed quite feasible to him.

Professor Weiss thought the resolution of the delegate from America quite agreed with Professor Klein's idea. Professor Rücker supported a resolution of this nature. He thought that the next scheme published should have some international weight.

Chevalier Descamps agreed in the main with the plan, though he remarked, in passing, that Belgium was not represented on the Committee. Professor Darboux and Dr. Graf discussed the best method of arriving at the opinions of the scientific men in the various countries. Dr. Mond thought the delegates from the various countries were the best medium for establishing the Committees; otherwise he favored the appointing of an International Committee as the best means of arriving at a definite conclusion—a view which was supported by Professor Klein.

M. Mascart requested permission to present the following resolution: "The Conference is of the opinion that the delegates be requested to take steps in their respective countries to organize local commissions charged to represent the Royal Society in the various countries; to study all questions relative to the International Catalogue of Scientific Literature, and to send a report to the International Committee."

Professor Foster favored the resolution introduced by Dr. Adler. The Royal Society had done its best, and the matter should now be left to a broader court, this latter body to be an authoritative one empowered to make final decisions. He did not regard this commission as representing different countries, but simply as composed of men chosen by this Conference.

Dr. Bernoullii suggested that the schedules be submitted to the various International Congresses, such as the Mathematical, Zoological and Chemical, etc.

Professor Foster replied that the Congresses of Zoology and Physiology met only once in three years. The matter had been brought to the attention of the Congress of Physiology, but not seriously discussed. He thought a Congress the worst body possible to which to submit the questions.

M. Mascart stated that after hearing the discussion he desired to modify his amendment in the following manner: "The Conference holds the view that the delegates be requested to take steps through the governments of their respective countries to organize local commissions charged with studying all the questions relative to the cataloguing of scientific literature of the Royal Society, and to send a report in six months to an International Committee constituted under the patronage of the Royal Society. The International Committee shall examine all the solutions sent and reach a definite decision."

Professor Klein agreed with the proposition, pointing out, however, that the time allowed was too short, and declaring that any connection with International Scientific Congresses was impracticable, as they had no permanent organization. The debate continued for some time, and finally the first portion of Dr. Adler's motion, modified by Professor Klein, "That the authoritative decisions as to the schedules be intrusted to an International Committee to be hereafter named by the Conference, together with three representatives of the Royal Society," was unanimously agreed to. The resolution of M. Mascart concerning the appointment of local committees to report in six months was next adopted, and a further resolution that the International Committee frame its report not later than July 31, 1899.

Professor Boltzmann brought up the subject of some additional classes to be added to the list of sciences, more especially a class of general science. Professor Foster objected to having the subject reopened, and after a lengthy discussion the President ruled the discussion out of order; which, it may be said, was the single case of such a ruling at the Conference.

President Foster next raised the question of the functions of the regional bureaus. Dr. Graf stated the difficulties which were in the way of the organization of a regional

bureau in Switzerland, and thought it best that all the work be done by a central bureau. Professor Rücker pointed out that it would probably be easier for the various countries to find the money to pay for work done within their own borders. He also thought that in time authors could be got to prepare their own analyses. Dr. Bernoulli agreed with the opinion of his colleague. Dr. Graf and M. Otlet also supported the idea of a single central bureau. Professor Darboux, however, warmly upheld the decision reached at the first Conference, of having a central bureau and regional bureaus. All the resolutions relating to this subject as well as to the business conduct of the bureau were finally adopted, or referred to the International Council. They are given in the Acta and need not be referred to here.

The next matter of importance was with regard to the persons who should form the International Committee.

This was discussed at length, informally (the discussion not being reported), and it was finally agreed that the members be Professor Armstrong, Chevalier Descamps, Professor M. Foster, Dr. S. P. Langley, Professor Poincaré, Professor Rücker, Professor Waldeyer and Professor Weiss, with the understanding that the Committee may appoint substitutes, should any member be unable to serve, and that it have the privilege of adding two members.

M. Mascart then called attention to the desirability of the passage of a resolution which would give the Central Bureau the power of modifying decisions of the Conference, should they be found impracticable; and this, after discussion, was agreed to. There were some further remarks about the arrangement of the various sciences, which resulted in no formal action, it being held that the International Committee was competent to deal with these matters.

The final sitting of the Conference was devoted to the consideration of the finances of the Catalogue.

Professor Rücker, on behalf of the Royal Society, stated that, while they had not gone into the matter in great detail, they were of the opinion that their estimates were approximately correct. The cost of producing the Book Catalogue was, in round numbers, £5,600. The least remunerative number of complete subscribers would be 350, taking the average of the complete subscription of £16. For the Primary Slip Catalogue a further £3,000 per annum would be necessary, which would be met by 130 complete subscriptions. This estimate is based upon the use of the linotype system. The Secondary Slip Catalogue would cost, in round numbers, £6,000 per year. If the scheme were carried out on this scale it would be possible to supply 133 cards for a franc, or 160 cards for a shilling. It was the hope of the committee that the Catalogue would ultimately pay its own way, though some plan must be found for guaranteeing its success. One way would be to receive direct subscriptions from foreign countries, as is done in the case of other international bureaus, or a guarantee fund might be established. The minimum period of experiment for the Catalogue would be fixed at five years, and should the entire scheme for books and cards be entered upon, a sum like £40,000 would have to be guaranteed to make sure of the success of the plan for the period of five years. This would be met if, say, ten of the great powers each take one share, the smaller powers two between them and the English colonies one amongst them; each share would then amount to £4,000 in the course of five years.

The delegates of the various countries were then requested to state what their countries might be expected to do.

Professor Klein, for Germany, stated that he was in no wise authorized to enter into

any engagements; he said, however, that at a recent conference of German scientific men it had been decided to recommend to the German government a subvention of 12,000 Marks per annum for the regional bureau; he was also prepared to recommend a subvention of £1,000 for the central bureau.

Professor Weiss stated that the Austrian government had agreed to provide fully for the expense of a regional bureau. The Vienna Academy was prepared to recommend a subvention of £200.

Doctor Heller said, in the name of the Hungarian government, that he had been authorized to state that the regional bureau for Hungary would be completely provided for at the expense of the Hungarian Academy of Science. He was not prepared to make any statement with regard to the guarantee fund.

Professor Darboux stated for France that his country would undertake the organization of a regional bureau, but with regard to a subvention he thought it difficult to obtain it outright; it might be much more feasible to accomplish the same result by guaranteeing a subscription to a certain number of copies of the Catalogue. Professor Rücker stated that such an arrangement with regard to subscriptions would be equivalent to a guarantee and would be satisfactory.

Doctor Adler stated, on behalf of the United States, that he was not authorized to make any agreement in regard to expenses; that in accordance with the recommendation of Dr. Billings and Professor Newcomb, delegates to the previous Conference, the Secretary of State had asked an appropriation of £2,000 per annum for the establishment of a regional bureau. He did not think that in any event the United States government could be brought to contribute to a guarantee fund, and if this were necessary it could be done more readily through universities and scientific societies, and that the most feasible plan for the United States was that suggested by Professor Darboux, a given number of subscriptions to the Catalogue.

Dr. Graf, speaking for Switzerland, stated that he was prepared to make no promises, but that the plan suggested by Professor Darboux, to have his government subscribe for a given number of copies of the Catalogue, would be the one most easily carried out in his country.

Chevalier Descamps stated that he had no instructions from his government, but thought that the proposition made by Professor Darboux, that is, a subscription of a given number of copies, was one that Belgium would be most likely to carry out.

No definite statements were made on behalf of Norway, Sweden and Japan, the delegates being without instructions.

Sir John Gorst, speaking for Great Britain, stated that he too was without authority to pledge his government, but thought that the British government would be more likely to subscribe for a number of copies of the Catalogue than to give a guarantee.

It was suggested by Professor Foster that the delegates be requested to obtain information at an early date as to what assistance might be expected from their respective countries towards the expenses of the central bureau.

M. Mascart thought that the plan was still too indetermined to make the question of expense sufficiently definite. Professor Klein also seemed to think this somewhat premature; that the whole matter depended as to whether the scheme for the Catalogue could be brought into such form that one might say: "This is good, and we agree that it should be done in this way."

Dr. Graf desired that the Provisional International Committee should take the opportunity of examining the bibliographical

work now in actual operation in Switzerland, mentioning that of Dr. Field.

It was agreed further that the time of calling the Provisional International Committee together be left to the Royal Society.

Some discussion arose at this point with regard to the meaning of Article 22, as to whether the delegates continue to exist as delegates after the adjournment of the Conference. There was a joint agreement that the committees should be appointed by the delegates, and the report of these committees transmitted by the delegates.

After a vote of thanks to the Society of Antiquaries, and to the President, Sir John Gorst, the Conference adjourned.

It would seem ungracious not to mention the very pleasant hospitalities of the Royal Society, which gave a dinner to the delegates, presided over by its distinguished President, Lord Lister, and of the English delegates, who also gave a dinner, presided over by Sir Norman Lockyer.

The delegates had frequent meetings outside of the regular meetings of the Conference, which fact expedited the work. There was no division or national lines, all the conclusions being reached either as a result of the individual opinions of those present or based upon conditions existing in the country of the particular delegate.

The official Acta of the Congress were printed in the issue of SCIENCE for November 11, 1898.

On returning from abroad I submitted the accompanying report to the Secretary of State:

WASHINGTON, November 15, 1898.

SIR:

Having been appointed, together with Mr. S. P. Langley, Secretary of the Smithsonian Institution, a delegate on the part of the United States to the Conference on an International Catalogue of Scientific Literature, to be held at London on July 12, 1898, we proceeded abroad on July 2nd.

The British Government found it expedient to postpone the conference until October 11. At the request of the Department, and with the consent of the Secretary of the Smithsonian Institution, I continued abroad and attended the Conference. Mr. Langley's official duties necessitated his return to the United States in September.

The deliberations were in continuation of those had at a previous Conference in 1896, at which this Government was also represented. Satisfactory conclusions were reached, leaving only such questions as can be definitely determined by an International Committee, on which the United States is represented by Mr. Langley.

I have the honor to transmit herewith the Acta of the Conference. The *procés verbal* will be issued later, and a copy forwarded to the Department.

I beg most respectfully to bring to your notice the report of the delegates of the United States to the first Conference (Professor Simon Newcomb and Doctor J. S. Billings) to repeat the recommendations made by them, and to further draw your attention to the recommendation of the Secretary of the Smithsonian Institution, all of which is contained in Senate Document No. 43, 54th Congress, 2nd session, a copy of which is herewith appended.

I have much pleasure in informing you that both in public and privately, the Delegates of the United Kingdom, and of other Powers, expressed a very generous appreciation of the scientific activity of the United States, and I beg to be allowed to commend to the favorable consideration of the Department, the recommendation of such legislation as will enable the United States to worthily take its share in this highly important International project.

I have the honor to be

Sir, Your most obedient servant,

(Signed) CYRUS ADLER.

THE HONORABLE,
THE SECRETARY OF STATE.

His reply is given herewith:

L S DEPARTMENT OF STATE,

Washington, November 25, 1898.

PROFESSOR CYRUS ADLER,
Smithsonian Institution, Washington, D. C.

SIR: I have to acknowledge the receipt of your letter of the 15th instant in regard to the work of the Conference on an International Catalogue of Scientific Literature which met at London on the 11th ultimo and to which you were a delegate on the part of the United States.

With reference to your suggestion that such legislation be recommended to Congress as will enable the United States to worthily take its share in this highly useful and important international project, I have to state that I had already in the estimates for this De-

partment for the fiscal year ending June 30, 1900, submitted an item of $10,000, or so much thereof as may be necessary, for the purpose of carrying out on the part of the United States the recommendation of the International Conference on a Catalogue of Scientific Literature, and for the expense of clerk hire and for the other expenses of the work of cataloguing the scientific publications of the United States, the same to be expended under the direction of the Secretary of the Smithsonian Institution, and pointed out that as the preparation of the catalogue is to begin on January 1, 1900, it would be necessary for appropriate action to be taken by Congress at its forthcoming session, if this Government is to participate therein.

In support of this recommendation, I enclosed as appendices a copy of the Congressional document to which you refer and a copy of your report on the Conference of 1896. The estimates are now in print and it is too late to have your present letter included therein; but I shall, upon the assembling of Congress, communicate it to that body in further support of the item.

I am Sir,
Your obedient servant,
(Signed) JOHN HAY.

The following additional communication from the Department has also been received:

T/W DEPARTMENT OF STATE,
Washington, December 16, 1898.

DR. CYRUS ADLER,
Delegate of the United States to the Second International Conference on a Catalogue of Scientific Literature, Smithsonian Institution.

SIR: I enclose for your information copy of a note from the British Ambassador at this capital, conveying to this Government an expression of the grateful appreciation of the President and Council of the Royal Society for the cordial coöperation of the American Delegate in the arduous and difficult work of the recent Conference on a Catalogue of Scientific Literature.

I am Sir,
Your obedient servant,
(Signed) DAVID J. HILL,
Assistant Secretary.

Enclosure:

From British Ambassador, December 12, 1898, with enclosures.

Washington, December 12, 1898.

THE HON. JOHN HAY,
Secretary of State.

SIR: With reference to my note of July 12th respecting the International Conference in furtherance of the project of an International Catalogue of Scientific Literature I am instructed by Her Majesty's principal Secretary of State for Foreign Affairs to convey to the United States Government the grateful appreciation of the President and Council of the Royal Society for the cordial coöperation of the United States Delegate in the arduous and difficult work of the Conference.

I am also instructed to furnish you with four copies of the Acta of the Conference, two for the use of the United States Government, and two for that of their Delegate.

I have the honor to be
with the highest consideration
Sir:
Your obedient Servant,
(Signed) JULIAN PAUNCEFOTE.

The House of Representatives took no action in pursuance of the request of the Secretary of State, but the following amendment to the Diplomatic and Consular Bill was reported to the Senate and passed by that body.

INTERNATIONAL CONFERENCE ON A CATALOGUE OF SCIENTIFIC LITERATURE.

For the purpose of carrying out on the part of the United States the recommendation of the International Conference on a Catalogue of Scientific Literature, held in London in July, 1896, for the expense of clerk hire and other expenses incident to the work of cataloguing the scientific publications of the United States, the same to be expended under the direction of the Secretary of the Smithsonian Institution, five thousand dollars.

The Amendment was, however, disagreed to in Conference and lost.

The following petitions in behalf of the proposition were presented to the Senate:

THE PUBLIC LIBRARY OF THE CITY OF BOSTON,
Boston, Mass., January 25, 1899.

HON. GARRETT A. HOBART,
Vice-President of the United States, President of the Senate.

SIR: The trustees of the Public Library of the City of Boston understand that Congress is to be asked for an appropriation to be placed at the disposal of the Smithsonian Institution to enable that institution to render necessary service in connection with the Royal Society index of scientific publications.

The trustees beg to urge upon you the importance of this undertaking. Although it carries the name of

the Royal Society, it is in fact international ; it has been organized by representatives from the various civilized countries ; its benefits will be shared by all civilized countries, and the index itself will be the product of contributions from them. The contribution asked for is not a direct gift of money, but a special service. For this country the proper agency for such service is at present the Smithsonian Institution. This institution cannot undertake it with its ordinary funds, and requires for it a special appropriation.

The amount of this is small compared with the importance of the service to be rendered.

Full information as to the details of the undertaking and of the particular work for which the appropriation would be expended will no doubt be laid before Congress.

The trustees of this library content themselves with calling to your attention the significance of the undertaking itself, and desire to express their conviction that the benefits which will result to libraries and other learned institutions and to individual scholars throughout the United States will be a most ample return for the expenditure proposed.

Very respectfully,

THE TRUSTEES OF THE PUBLIC LIBRARY OF THE CITY OF BOSTON :

FREDERICK O. PRINCE, *President*,
SOLOMON LINCOLN, *Vice-Peesident*,
JOSIAH H. BENTON, JR.,
HENRY P. BOWDITCH,
JAMES DE NORMANDIE.

By order of the board.

Attest :

HERBERT PUTNAM, *Clerk*.

Mr. Platt, of New York, presented the following resolution of the Board of Trustees of the New York Public Library, Astor, Lenox and Tilden Foundations :

"WHEREAS, The honorable Secretary of State has recommended to Congress the appropriation of the sum of $10,000, to be expended under the direction of the Smithsonian Institution, for cataloguing the current scientific literature of the United States, to form a part of an International Catalogue of Scientific Literature : and

"WHEREAS, Each of the great European nations has undertaken to catalogue in like manner its own scientific literature for the same purpose, the whole to be edited and published by a central bureau : Therefore,

"*Resolved*, That the trustees of the New York Public Library, Astor, Lenox and Tilden Foundations, respectfully urge upon Congress the great desirability of making the appropriation requested by the honorable Secretary of State for this purpose, as the work to be done is international in character and will be for the benefit of all scientific men and of all libraries and institutions of learning in the United States."

The motion was agreed to.

Petitions were also presented by the American Library Association and the John Crerar Library of Chicago, and a strong endorsement of the project was sent to the Committee on Appropriations by the Secretary of State.

For the purpose of obtaining the advice of scientific men and persons interested, in accordance with Resolution 22 of the Conference, the following Committee was named on the part of the United States : Dr. J. S. Billings, Chairman ; Professor Simon Newcomb, Dr. Theo. N. Gill, Professor H. P. Bowditch, Dr. Robert Fletcher, Mr. Clement W. Andrews, Mr. Herbert Putnam and Dr. Cyrus Adler. This Committee requested that Harvard University, Yale University, Columbia University, the University of Pennsylvania, Princeton University, Johns Hopkins University, the University of Michigan, the University of Chicago, Leland Stanford Junior University, the American Museum of Natural History, the Academy of Natural Sciences, the American Philosophical Society, the Library of Congress, the United States Coast and Geodetic Survey, the United States Geological Survey and the United States Weather Bureau appoint committees on the subject, these committees to report to the Committee above named by April 15th.

The request was generally acceded to, and with a few exceptions reports have been received which represent the opinions of a large number of scientific men and librarians in this country.

All of these reports and various informal suggestions were considered, and a series of resolutions, together with the reports, have

been transmitted to the Secretaries of the Royal Society, with an occasional expression of opinion as to the merits of the views presented in the several reports.

The next step will be the consideration of these reports and of similar reports from other countries and the formulation of a definite plan by the Provisional International Committee.

In view of the failure of Congress to make an appropriation for carrying on the work in this country, it will be necessary should the Catalogue begin January 1, 1900, to make some special provision. It is hoped that, by the cooperation of universities and libraries in five or six of the large centers, the work can be carried on for one year, and that when the subject is next presented to Congress it will meet with more favorable consideration.

Cyrus Adler.

Smithsonian Institution.

A DOUBLE INSTRUMENT AND A DOUBLE METHOD FOR THE MEASUREMENT OF SOUND.

The work briefly sketched here, at the request of the editor of Science, was done by the writer in the laboratory of Clark University, and grew out of the suggestion of Professor Webster, that the optical arrangement of Michelson's refractometer, combined with an accoustical method employed by Wien,* might yield a sound-measuring apparatus of great sensitiveness.

RECEIVER.

For this purpose one totally reflecting mirror of the refractometer was made very small and light, and was mounted upon a thin glass plate, which formed a portion of the walls of a spherical, Helmholtz resonator. A pure tone of the same pitch as the resonator causes the interference bands to vibrate with the same frequency. In order to render the maximum displacement visible, the fringes were made vertical, then cut down to a narrow band by a screen with a horizontal slit. This band was viewed by means of a telescope whose object glass was a small lens mounted upon the end of a tuning fork of the same frequency as the source of sound. The fork was driven electrically and the motion of the lens was perpendicular to the narrow band, so that, if the sensitive resonator plate were protected from all sound, the fringes would not be displaced, but the motion of the object glass would stretch out the narrow band into a broad band of vertical fringes. If now a tone were admitted to the resonator the fringes would be simultaneously displaced. In case of the identical agreement of both frequency and phase of the telescope fork with the forced vibration of the resonator plate (excited by the source of sound) the composition of motions would result in a similar band, but one covered with oblique fringes whose slope is a function of the intensity of the sound. Identity of phase is easily realized by making the telescope fork actuate the source of sound; but identity of phase depends upon the distance of the source of sound (as well as upon some elements involved in the mechanical construction of the source of sound, which elements cannot be varied within limits sufficiently wide to compensate for all phase differences depending on various distances of the source), and consequently this identity could be obtained only at particular settings. In a room filled with standing waves from the source, these settings can be found by moving in the three dimensions either the source of sound or receiver. But this adjustment is laborious, and this limitation renders the apparatus unsuited to general investigation. Without such adjustment the composition of the motions of the bright spots in the narrow band gives a set of overlapping ellipses, obscuring the displacement.

* Wied. Ann., 1889, p. 835.

Accordingly the frequency of the lens fork was made slightly different from that of the source, by loading it sufficiently to obtain slow beats. Thus the phases of the one overtook those of the other very slowly, and consequently the interference bands were obtained, sloping first to the right and then after an interval to the left, the changes occurring periodically and following each other as slowly as desired. By means of a suitable eye-piece with divided circle the angle of this slope can be measured, and gives immediately a means of measurement of relative intensities.

CAMERA.

For some work the stroboscopic method of direct observation was replaced by a photographic method by which permanent records of sound disturbances were obtained and intensities determined. In this case the telescope with vibrating eye-piece was replaced by a fixed lens system which focussed a narrow band of fringes upon a sensitive film mounted upon a uniformly revolving cylinder, in a manner similar to that employed by Raps.* The cylinder was driven by a small motor, whose speed was kept constant by Lebedew's† method. Since this photographic record can be made equally well in case of irregular disturbances of the air, the instrument, with the receiving resonator removed from the sensitive plate, affords an unequalled means of studying the physical characters of a great variety of sounds and noises, such as vowel sounds and consonants, the notes of various musical instruments, the calls of birds, the cries of animals, bells, whistles, the din of the streets, the rumble of thunder, etc. The effect of the peculiar note of the sensitive plate may be eliminated by means of differential measures with plates of different natural periods.

* Wied. Ann., 1893, p. 194.

† Wied. Ann., Band 59, s. 118.

SOURCE OF TONE.

For the determination of the instrumental constants, and for fundamental researches in sound, it is essential that the source of sound be pure in tone, constant in intensity, and that its intensity be easily varied within considerable limits. It should also be portable. The following arrangement meets these requirements in a very satisfactory manner. A tuning fork of about the same pitch as the note desired was driven by an electromagnet with a current interrupted by a similar *control* fork, electrically driven by the usual method of self-interruption. The first fork was fastened vertically upon a heavy iron base, and one of its tines was connected to a circular, thin iron plate, of approximately, the same pitch as the fork, by means of a short stiff wire. This plate formed a side of a Helmholtz resonator, constructed to give the note desired and rigidly supported. The motion of the fork tine was in the direction of the wire, *i. e.*, perpendicular to the plane of the plate, so that the vibrations of the fork were communicated to the plate; thus the air within the source resonator is thrown into forced vibrations of very nearly its own frequency. Accordingly a very small vibration of the fork causes the resonator to emit a very loud tone. Its intensity depends upon the current driving the source fork, and this current is governed by a sliding resistance and shunt. A single storage cell suffices for the loudest tones, and $\frac{1}{50}$ ampere produced a tone loud enough to be heard very distinctly all over a large lecture room (about 14x24 yards). This source was enclosed in a heavy, padded box, so that only the lip of the resonator protruded. Perfect silence could be obtained by simply corking the mouth of the resonator with a rubber stopper, so that a single and definitely located source was obtained, and one which is portable.

Care was taken that no sound should

reach the receiving resonator from the telescope-fork, for it also was carefully boxed. The box was provided with glass windows for the transmission of the beam from the refractometer, which was similarly boxed in such a way that a portion of the receiving resonator protruded and pulsations of sound acted only upon the side of the sensitive plate which faced the mouth of the resonator. The adjusting screws of the refractometer were brought outside the box. The whole was small and portable. Equal care was taken to keep all sounds from motor and cylinder from reaching the receiving resonator, and all these pieces rested upon little piers of soft rubber and tin in layers, this to prevent vibrations from being transmitted through the table and supports. Careful tests were made for immunity from such disturbances.

Results obtained thus far give promise of a high degree of constancy, and of sensitiveness greater than the human ear, *i. e.*, ability to detect both extremely faint sounds, such as escape the sense of hearing, and also the most minute differences in intensity For this reason this instrument may prove useful in the psychological laboratory.

The limits of this sketch allow but an outline of the mathematical theory of the source, and of the receiver, by which the intensity of a tone is reduced to absolute measure. For a measure of intensity can be made independently by each, and one may be used as a check on the other.

ENERGY OF SOURCE.

The energy emitted by the source resonator in sound may be measured in a manner analogous to one employed by Rayleigh* in determining the minimal sound. The rate at which the source fork expends its energy is readily shown to be

$$-\frac{d}{dt}(E_n) = KE_o e^{-Kt_n} = KE_n \text{ per sec.},$$

* *Phil. Mag.*, 1894, p. 365.

and this energy is constantly supplied by the current driving the fork. But not all this energy is converted into sound. In fact K is composed of three distinct parts :

K_1	peculiar	to	the	fork	alone,
K_2	"	"	"	plate	"
K_3	"	"	"	resonator	"

If the resonator is made very smooth within we may neglect the dissipation of energy in other forms within the resonator and say that the production of tone is due to K_3 for the system. Accordingly the energy of the tone produced is $K_3 E_s$, when E_s represents the sum of the energy of fork, plate and connection at the time. The energy of fork and connection are approximately

$$E_f = \tfrac{1}{4}\rho l\omega\pi^2 (2\eta)^2 {}^1/\tau^2 \text{ for fork},$$
$$E_c = \tfrac{1}{8}\pi^2 M_c (2\eta)^2 {}^1/\tau^2 \text{ " connection.}$$

The energy of the plate is an infinitesimal of the second order.

Since $2\eta = Ae^{-\frac{1}{2}Kt}$, K can be obtained by noting the time required for the amplitude to fall one-half. The resonator plate is mounted upon a separate ring so that the resonator may be removed without disturbing the plate. Then a differential measure serves to determine K_3. First, K is determined with resonator in place; then the resonator is removed and $K_1 + K_2$ is determined; thence

$$K_3 = K - (K_1 + K_2) = 2\log_e 2\,({}^1/t_1 - {}^1/t_2).$$

A galvanometer, or millivoltmeter, is interposed in the circuit containing the source forks, so that a few measures, taken through some range of intensities, suffice to calibrate the current in terms of absolute intensity at the mouth of the resonator. From this a simple assumption regarding propagation gives the intensity at any point. Since the intensity can be varied at will, this instrument alone, with the ear for receiver, can be employed for a considerable number of investigations.

ENERGY AT RECEIVER.

The energy of the tone at the mouth of the receiving resonator is proportional to the square of the amplitude of vibration of the sensitive plate. And since this plate carries one of the refractometer mirrors its amplitude can be expressed in terms of wave-lengths of monochromatic (sodium) light. In short, an expression for relative intensity will be:

$$\left(\frac{B \tan a}{w}\right)^2$$

when B is the double amplitude due to the motion of object glass, a is the slope of the fringes due to tone, and w is the width of a double fringe. This relative measure can be reduced to absolute measure in a manner differing from that employed by Wien* only in the fact that the energy of the little mirror is taken account of and the identical resonator in the identical position, but with plate of high pitch, is used to calebrate the sensitive arrangement in absolute units.

This combination of source and receiver seems exceptionally well adapted to the investigation of such problems as the variation of the intensity of sound with distance, the viscosity of the air, sound shadows, reflection of sound from various substances, refraction of sound in various media, the distribution of sound in a room, with the natural pitch and damping (echo) of a room, intensity of the minimum sound audible, test of Weber's Law,† etc.

The elaboration of the instrument has left, thus far, no opportunity for systematic research. Some results of interest have been obtained, such as tests for constancy and sensitiveness, photographs of vowel and other sounds; but these results are fragmentary, and have been of value chiefly to serve the purpose of tests, and of suggestion to further improvements in means or method. In the near future some acoustical problems will be attacked in the laboratory of Clark University, and the results, as well as a fuller account of instruments and method, will be published, it is planned, jointly by Professor Webster and myself.

BENJAMIN F. SHARPE.

GREENWICH, N. Y., June, 1899.

*Wied. Ann., 1889, p. 834.

†Fechner, 'Hauptpuncte der Psychophysik,' p. 185.

NEW YORK STATE SCIENCE TEACHERS ASSOCIATION.

THE third annual meeting was held at the Teachers College of Columbia University, December 29 and 30, 1898, affording to the members of the Association an opportunity to attend most of the meetings of the Society of Naturalists.

Dr. Charles B. Davenport, of Harvard University, read a paper on zoology as a condition for admission to college. He favored the study of animals by the laboratory method as outlined in the Harvard requirements, and thought that too much attention was being given to dissection in most secondary schools. He encouraged the study of economic zoology in a preparatory course, leaving most of the dissection to be done in the college.

The first afternoon was devoted to the report of the Committee of Nine, by Dr. Le Roy C. Cooley, after which the Association attended the annual discussion of the Society of Naturalists on 'Advances in Methods of Teaching.' In the evening the President, Dr. Charles W. Hargitt, delivered the annual address, on 'Science and the New Education,' in which he defined the relation of science to the other elements of the modern curriculum. The address was followed by a most enjoyable reception by the Trustees of Teachers College.

The second day began with four simultaneous section meetings. Section A, Biology, in charge of Dr. Charles L. Bristol,

discussed three papers: Professor George F. Atkinson, on 'Entrance Requirements for the University in Botany and Zoology'; Professor James E. Peabody, on 'Physiology in the High School,' and Miss Idelette Carpenter on 'The Teaching of Botany in the Girls High School of New York.'

Section B, Earth Science, conducted by Professor Richard E. Dodge, considered papers by the Chairman, by Mr. E. W. Sampson and by Miss L. Belle Sage. Section C, Nature Study, in charge of Mr. Charles B. Scott, attracted a larger number of teachers than any other, and presented too many papers to be mentioned in detail in this report. The discussions dealt principally with the aims of nature study, the materials for study, and plans for helping teachers. An excellent report of this section appears in the February number of *New York Education* (Albany). Section D, Physics and Chemistry, conducted by Professor Albert L. Arey, discussed these sciences from the point of view of the secondary schools, the colleges and the Regents. Professor Edwin H. Hall, of Harvard University, Dr. William Hallock, Dr. Edward L. Nichols, Professor Frank Rollins, Mr. Charles N. Cobb and Professor Irving P. Bishop presented papers.

Following the Section meetings Dr. C. F. Hodge, of Clark University, spoke on 'The Active Method in Nature Study.' Mr. Arthur G. Clement read a paper on 'The Use of the Microscope in Secondary Schools.' At the last session, which was held in the American Museum of Natural History, Mr. Frank M. Chapman gave an illustrated lecture on 'The Educational Value of Bird Study.'

The Association cordially endorsed the report of the Committee of Nine, and asked a continuation of their work for another year. Resolutions were adopted in favor of one year of physical science, one of biological science and one of earth science in all the secondary schools of the State, and steps were taken toward the recommendation of subject-matter and effective methods in each of these branches. It was also resolved "That any physical, biological or earth science which has been pursued consecutively for one full year, by the approved class-room and laboratory methods, and which has stood the approved tests for quality, should be accepted by the colleges for admission to their freshman classes."

Authority was given to a committee of five "to ascertain and report what is definitely known regarding the physiological effects of alcohol and narcotics on the human body, and to recommend suitable methods for teaching the same in the schools of this State."

The sessions were well attended and the character of the papers and discussions was a sufficient evidence of the interest that centers in the Association and its work. The Teachers College provided amply for all the wants of the visitors and made their stay in the city comfortable as well as profitable.

A complete report of the meetings will be published by the Regents and may be obtained by applying to the Secretary of the Association.

The next meeting will be held at Syracuse during the Christmas holidays.

The following officers were chosen for 1899: President, Le Roy C. Cooley, Vassar College, Poughkeepsie. Vice-President, Albert L. Arey, Rochester Free Academy, Rochester. Secretary and Treasurer, James E. Peabody, The High School, 3080 Third Avenue, New York City. Executive Council, Mr. Charles N. Cobb, Regents Office, Albany; Dr. Franklin W. Barrows, Central High School, Buffalo; Professor J. H. Comstock, Cornell University, Ithaca; Professor William Hallock, Columbia University, New York; Miss Mary E. Dann, Girls High School, Brooklyn; Professor D. L.

Bardwell, State Normal School, Cortland; Dr. Charles W. Dodge, University of Rochester; Principal Thomas B. Lovell, High School, Niagara Falls; Professor, W. C. Peckham, Adelphi College, Brooklyn; Professor J. McKeen Cattell, Columbia University, New York; Professor John F. Woodhull, Teachers College, New York; Professor E. R. Whitney, High School, Binghamton.

FRANKLIN W. BARROWS.

SCIENTIFIC BOOKS.

Urkunden zur Geschichte der nichteuklidischen Geometrie. Von F. ENGEL und P. STAECKEL. *I. Nikolai Ivanovitsch Lobatschefski.* Leipzig, B. G. Teubner. 1899. 8vo. Pp. 476.

The name of Lobachévski is inseparably connected with a scientific advance so fundamental as actually to have changed the accepted conception of the universe.

Yet his first published work and his greatest work have both remained for over sixty years inaccessible, locked up in Russian, and are now for the first time given to the world in this monumental volume by Professor Engel.

As to the precise time at which Lobachévski shook himself free from Euclid's two thousand years of authority there is still room for a most interesting doubt.

The first of the two treatises given in this book, 'On the Elements of Geometry,' was published in 1829, with this note at the foot of the first page:

"Extracted by the author himself from a paper which he read February 12, 1826, in the meeting of the Section for Physico-mathematic Sciences, with the title: 'Exposition succincte des principes de la Géométrie, etc.'"

Again, when the four equations are reached which really contain the essence of the non-Euclidean geometry, Lobachévski subjoins this note: "The equations (17) and all that follows these the author had already appended to the paper which he presented in 1826 to the Section for Physico-mathematic Sciences."

In the introduction to the second of the two treatises here given, the 'New Elements of Geometry,' the author says: "Everyone knows that in geometry the theory of parallels has remained, even to the present day, incomplete.

"The futility of the efforts which have been made since Euclid's time during the lapse of two thousand years to perfect it awoke in me the suspicion that the ideas employed might not contain the truth sought to be demonstrated, and for whose verification, as with other natural laws, only experiments could serve, as, for example, astronomic observations.

"When, finally, I had convinced myself of the correctness of my supposition, and believed myself to have completely solved the difficult question, I wrote a paper on it in the year 1826, 'Exposition succincte des principes de la Géométrie, *avec une démonstration rigoureuse du théorème des parallèles*,' read February 12, 1826, in the séance of the physico-mathematic Faculty of the University of Kazan, but never printed." No part of this French manuscript has ever been found. The latter half of the title is ominous.

For centuries the world had been deluged with rigorous demonstrations of the theorem of parallels. We know that three years later Lobachévski himself proved it absolutely indemonstrable.

Yet the paper said to contain material to stop forever this twenty-centuries-old striving still was headed 'démonstration rigoureuse,' just as Saccheri's book of 1733 containing a coherent treatise on non-Euclidean geometry ended by one more pitiful proof of the parallel-postulate.

If Saccheri had lived three years longer and realized the pearl in his net, with the new meaning, he could have retained his old title: 'Euclides ab omni naevo vindicatus,' since the non-Euclidean geometry is a perfect vindication and explanation of Euclid. But Lobachévski's title is made wholly indefensible.

A new geometry, founded on the contradictory opposite of the theorem of parallels, and so proving every demonstration of that theorem fallacious, could not very well pose under Lobachévski's old title. Least said, soonest mended. He never tells what he meant by it, never tries to explain it.

Yet Engel thinks that under this two thousand years stale title, 'avec une démonstration

rigoureuse du théorème des parallèles,' "Lobatschefskij sprach es klipp und klar aus, dass das Euklidische Parallelenaxiom niemals werde bewiesen werden können, weil es unbeweisbar sei."

At the International Mathematical Congress, 1893, I maintained in his presence that Felix Klein was utterly in error where in his 'Nicht-Euklidische Geometrie,' I., p. 174, he says of the letter from Gauss to Bolyai Farkas, 1799, "In this last letter is particularly said that in the hyperbolic geometry there is a maximum for triangle-area;" and again where he says, p. 175, "There can be no doubt that Lobachévski as well as Bolyai owe to Gauss's prompting the initiative of their researches."

Klein's only answer was that his position would be sustained when the public got access to Gauss's correspondence.

Staeckel and Engel have now had complete access to these papers, and this is what Engel says, pp. 428–9: "But at all events in Gauss's letters there is nowhere a support for this tradition; at no point of these letters can be found even the slightest intimation that Gauss connected the discoveries of Lobachévski and J. Bolyai with any direct or roundabout prompting from him.

"On the contrary the letters show (see p. 432 f. and Math. Ann. 49, p. 162, Briefwechsel G. B., p. 109) that Gauss throughout recognized the independence of both, exactly as he recognized that of Schweikart, whose independence of Gauss is subject to no doubt.

"With Staeckel I am at one herein that exactly this circumstance is particularly weighty for the decision of the whole question."

The whole scientific world will breathe a sigh of relief that Klein's ungenerous Göttingen legend, mortally wounded in 1893, is in 1899 annihilated forever.

More inexplicable is Klein's bald misinterpretation of Gauss's letter of 1799 to Bolyai Farkas. I gave this letter in my Bolyai as demonstrative evidence that in 1799 Gauss was still trying to prove Euclid's the only non-contradictory system of geometry, and also the system regnant in the external space of our physical experience. The first is false; the second can never be proven.

Summing up this same letter, Engel, p. 379, instead of finding in it the hypothetical white elephant of Klein's fairy tale, gives the utmost that can be attributed to it in the following sentence: "Hier ist er also ganz nahe daran, an der Richtigkeit der Geometrie, das heisst, des Euklidischen Parallelenaxioms zweifelhaft zu werden."

Five years later, in a letter of November 25, 1804, Gauss speaks of a 'group of rocks' on which his attempts had always been wrecked, and adds: "I have, indeed, still ever the hope that those rocks sometime, and, indeed, before my death will permit a passage. Meanwhile I have now so many other affairs on hand that at present I cannot think on it, and, believe me, I shall heartily rejoice if you forestall me and if you succeed in surmounting all obstacles." "Surely," says Engel, "that does not sound as if the authority of Euclid had diminished in power since the year 1799; on the contrary, one gets the impression that Gauss in 1804 rather stood more completely under its ban than before."

This was clearly the view of Bolyai János, whose autobiography, after quoting Gauss's letter of 1832, says: "In a previous letter Gauss writes he hopes some time to be able to circumnavigate these rocks—so then he hopes!!"

"These last words," say Staeckel and Engel in the *Mathematische Annalen*, "show a certain suspicion on the part of John against Gauss." But the mention of this earlier letter was highly natural.

János had known of it from boyhood. The joy of his triumph in solving what had baffled all the world for two thousand years was intensified by his knowing that even Gauss had tried and was hoping for the impossible.

His splendid trumpet call of glory announcing his creation of a new universe, scientiam spatii absolute veram exhibens, is answered how? Gauss answers that method and results coincide with his own *meditations* instituted in part since 30–35 years. But of these meditations Gauss had published never a word! How natural then for János to refer to his previous letter, where he still was hoping to prove Euclid's parallel postulate.

The equally complete freedom of Lobachév-

ski from the slightest idea that Gauss had ever meditated anything different from the rest of the world on the matter of parallels is demonstrated most happily.

Bartels, the teacher of Lobachévski, never saw Gauss after 1807, received at Kazan one letter from him in 1808, probably a mere friendly epistle containing nothing mathematical, and not another word during his entire stay there.

But in November, 1808, Schumacher, in Göttingen, writes in his diary that Gauss has reduced the theory of parallels to this, that if the accepted theory were not true there must be a constant *a priori* of length, 'welches absurd ist,' yet that Gauss himself considers this work not yet completed.

Thus in 1808 Gauss still vacillates. The proposition about the *a priori* given unit for length is due to Lambert, 1766, and on the supposed absurdity Legendre in 1794 had founded a pseudo-proof of the parallel postulate.

Thus until after 1808 Gauss had made no advance beyond the ordinary text books.

A most fortunate piece of personal testimony from the distinguished astronomer Otto Struve finishes the whole matter.

When at Dorpat in 1835 and 1836 Struve was attending his lectures, Bartels repeatedly spoke of Lobachévski as one of his first and most gifted scholars in Kazan.

Lobachévski had then already sent his first works on non Euclidean geometry to Bartels, but, as Struve writes, Bartels looked upon these works 'more as interesting, ingenious speculations than as a work advancing science.'

Struve adds he does not recall that Bartels ever spoke of any accordant ideas of Gauss.

Such misconception of the import of non-Euclidean geometry was due in part to that lack of grit or slip in judgment which let Lobachévski damn this child of his genius with the name 'Imaginary Geometry.'

If Lobachévski had possessed the magnificent Magyar mettle of Bolyai János, and dared to name his creation the Science Absolute of Space, he would not have taught mathematics with ability throughout his life without making a single disciple.

His 'New Elements of Geometry,' here at last made accessible to the world, is such a master piece that it remains to-day the completest and most satisfactory text-book of non-Euclidean geometry. Written at the flood of hope and confidence, with ardor still undampened, it is in his 'New Elements' preeminently that the great Russian allows free expression to his profound philosophic insight, which, on the one hand, shatters forever Kant's doctrine of our absolute *a priori* knowledge of all fundamental spatial properties, while, on the other hand, emphasizing the essential relativity of space, and the element of human construction, human creation in it.

Lobachévski's position is still, after sixty years, the necessary philosophy for science. No one has succeeded in finding any escape from its cogency. No one has gone beyond it.

Our hereditary geometry, the Euclidean, is underivable from real experience alone, and can never be proved by experience. Not only can the truth or falsity of Euclid's parallel postulate never be proved *a priori;* not even *a posteriori* can ever its *truth* be proved. Therefore, Euclidean geometry, in so far as Euclidean, must ever remain a creation of the human mind.

The introduction to the 'New Elements' contains a piercing critique of Legendre's attempts on the parallel-postulate.

Here at times Lobachévski almost condescends to be humorous. For example, he says: "Although Legendre designates his demonstration as completely rigorous, he, without doubt, thought otherwise, for he adds the proviso that a difficulty which one would perhaps still find can always be removed. For this he has recourse to calculations founded on the first familiar equations of rectilinear trigonometry, which it would be necessary previously to establish, and which just in this case are useless and lead to no result."

Here for the word *trigonometry* in the Russian of the 'Collected Works,' p. 222, Engel has substituted, p. 70, by some slip, the word *geometry*. Further on Lobachévski continues: "But Legendre has not noticed here that EF may possibly not meet AC. To overcome *this little difficulty* you have only to suppose that EF is the perpendicular from F on BD; but then

how can we conclude therefrom that FE = AB and the angle EFC = $\frac{1}{2}\pi$? It is not possible to mend the false deduction, wherein Legendre's inadvertence was so gross that, without remarking this grave error, he considered his demonstration as very simple and perfectly rigorous."

Now for a specimen of Lobachévski's philosophizing: "Strictly we cognize in nature only motion, without which sense impressions are not possible. Consequently all other ideas, for example, geometric, are artificial products of our mind, since they are taken from the properties of motion; and, therefore, space in itself, for itself alone, for us does not exist.

Accordingly it can have nothing contradictory for our mind if we admit that some forces in nature follow the one, others another special geometry.

To illustrate this thought, assume, as many believe, that the attractive forces diminish because their action spreads on a sphere. In the ordinary geometry we find $4\pi r^2$ as magnitude of a sphere of radius r, whence the force must diminish in the squared ratio of the distance.

In the imaginary (sic) geometry I have found the surface of the sphere equal to

$$\pi(e^r - e^{-r})^2,$$

and possibly in such a geometry the molecular forces may follow, whose whole diversity would depend, consequently, on the number e, always very great."

How far Lobachévski was, not only from Riemann's geometry with closed finite straight line, but also from the perspective point of view where the straight is closed by having only one point at infinity, is illustrated by the following sentences of the introduction. "I consider it not necessary to analyze in detail other assumptions, too artificial or too arbitrary. Only one of them yet merits some attention—the passing over of the circle into a straight line. However, the fault is here visible beforehand in the violation of continuity, when a curve which does not cease to be closed, howsoever great it may be, transforms itself directly into the infinite straight, losing in this way an essential property.

In this regard the imaginary geometry fills in the interval much better. In it, if we increase a circle all of whose diameters come together at a point, we finally attain to a line such that its normals approach each other indefinitely, even though they can no longer cut one another. This property, however, does not appertain to the straight, but to the curve which in my paper 'On the Elements of Geometry' I have designated as *circle-limit*."

Lobachévski anticipated in 1835 all that was said not long ago in the columns of SCIENCE on the length of a curve. For example: "In fact, however little may be the parts of a curve, they do not cease to be curves; consequently they can never be measured by the aid of a straight."

"Lagrange takes as foundation the assumption of Archimedes that on a curve one can always take two points so near that the arc between them may be considered greater than its chord, but smaller than the two tangents from its extremities. Such an assumption is actually necessary, but by it is destroyed the primitive idea of measuring curves with straights. Thus the evaluation of the length of a curve represents not at all the rectification of the curvature; but it seeks a wholly different aim—the finding of a limit which the actual measure would approach the more as this measure was made the more exact. But measuring is considered more exact the smaller the links of the chain employed. This is why in geometry one must show that the sum of tangents decreases while the sum of chords increases until the two sums differ indefinitely little from the limit both approach, which geometry assumes as length of the curve."

In the splendid treatise which follows this interesting introduction Lobachévski has given a complete coherent development and exposition of the non-Euclidean geometry. Until I visited Maros-Vásárhely it was not known that Bolyai János had actually commenced and made remarkable progress in an even greater, more masterful treatment of the whole matter. From the mass of John's papers tumbled in a big chest I singled out especially a manuscript in German entitled 'Raumlehre,' and on pointing out to Professor Bedöházi János some of the striking passages in it he promised its publication.

In SCIENCE for September 24, 1897, I mentioned these treasures as 'extended researches anticipating the discoveries of Cayley and Klein.' Engel now says of them, p. 393: "J. Bolyai had also commenced to work out a great and consecutive presentation of geometry, but what he had written down remained entombed in his papers and has never been published.

"Staeckel will before long make generally accessible so much of it as is suitable for publication, and it will then appear that J. Bolyai in his exposition set to work according to principles similar to those Lobachévski actually followed." But though Lobachévski has given his complete message to the ages, yet is perceptible a touch more masterful in even the brief two dozen pages of the young Magyar.

Through a given point to draw a parallel to a given straight; to draw to one side of an acute angle the perpendicular parallel to the other side; to square the circle—these problems would be sought in vain in the two quarto volumes of Lobachévski.

Bolyai János gives solutions of them startling in their elegance. For example (Halsted's Bolyai § 34), "Through D we may Draw DM ∥ AN in the following manner: From D drop DB⊥AN; from any point A of the straight AB erect AC⊥AN (in DBA), and let fall DC⊥AC. A quadrant described from the center A in BAC, with a radius = DC, will have a point B or O in common with ray BD. In the first case the angle of parallelism manifestly is right, but in the second case it equals AOB. If, therefore, we make BDM = AOB, then DM will be ∥ BN."

About 100 pages of Engel's book are devoted to a life of Lobachévski, yet no word is said of his wife, his children, his family life, his home fortunes and misfortunes, nor is mentioned the biography by E. F. Letvenov (St. Petersburg, 1894, pp. 79) containing romantic pictures of these eternal interests.

GEORGE BRUCE HALSTED.
AUSTIN, TEXAS.

The Spirit of Organic Chemistry. An Introduction to the Current Literature of the Subject. By ARTHUR LACHMAN, B.S., PH.D., Professor of Chemistry in the University of Oregon. With an Introduction by PAUL C. FREER, M.D., PH.D., Professor of General Chemistry in the University of Michigan. New York, The Macmillan Company. 1899. Pp. xviii +229. Price, $1.50.

Under the above title an historical account of the development of some of the most important chapters is given. The subjects selected are among those which have exercised the minds and skill of the greatest chemists, and which are to-day before the chemical world. Problems which have been solved in a single masterly research are omitted. In the nine chapters the following subjects are treated: The constitution of rosaniline, Perkins's reaction, the constitution of benzene, the constitution of aceto-acetic ether, the uric-acid group, the constitution of the sugars, the isomerism of fumaric and maleïc acids, the isomerism of the oximes, and the constitution of the diazo compounds.

The author has used excellent judgment in condensing the literature, and has presented the subject in a logical and clear manner. The account is brought up to date, even the most recent work receiving brief mention. The book is, therefore, an introduction to the chemical literature of to-day. On this account it is of special value to the student who has just mastered the text-books of organic chemistry and who desires to go farther. The mass of literature which is summed up in but 225 pages is so great and complex that it is doubtful whether the student would have the time and energy to get as clear a conception of the subject by searching through the journals as he can get by a careful study of this book. After mastering it he would be in a position to follow a paper on any of the subjects treated.

The literature of organic chemistry is so vast that there is room for such critical reviews, for, it seems to the writer, they tend to inspire rather than prevent reading. Professor Lachman's book will make the reading of the current journals easier and is, therefore, helpful. It is a contribution to chemical history and supplements Schlorlemmer's well-known "Rise and Development of Organic Chemistry."

JAMES F. NORRIS.
MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

Commercial Organic Analysis. By ALFRED H. ALLEN, F.C., F.C.S. Third edition, illustrated with revisions and addenda by the author and HENRY LEFFMANN, M.A., M.D. Volume II., Part I., Fixed oils, fats, waxes, glycerol, nitroglycerine and nitroglycerine explosives. Philadelphia, P. Blakiston's Son & Co. 1899. Pp. 387. Price, $3.50.

The new editions of Volumes I. and IV. of this excellent work were noticed in SCIENCE some time ago. The present part contains only a portion of the matter originally included in the second volume, the discussion of the hydrocarbons and their immediate derivatives being reserved for the second part of the same volume. The more important additions to this part are: the bromine thermal method, methods for the determination of glycerol, acetyl number, various tests for oxidation of oils, composition and official methods for examination of dynamites and smokeless powders, degras and cloth oils.

The standard character of the work is so well known that any detailed criticism is unnecessary. The revision has been well done and the book gives a good account of the present state of knowledge in what must be acknowledged as one of the most difficult as well as important fields of analytical chemistry.

W. A. NOYES.

BOOKS RECEIVED.

I Sogni. SANTE DE SANCTIS. Torino, Fratelli Bocca. 1899. Pp. 390.

Geometrical Drawing for Army and Navy Candidates and Public School Classes; Vol. 1., Practical Plane Geometry. EDMUND C. PLANT. London and New York, The Macmillan Company. 1899. Pp. xiv + 185.

Poems of Nature and Life. JOHN WITT RANDALL. Edited by FRANCIS ELLINGWOOD ABBOT. Boston, Ellis. 1899. Pp. 556.

The Making of Hawaii, a Study in Social Evolution. W. F. BLACKMAN. New York and London, The Macmillan Company. 1899. Pp. xii + 266.

SOCIETIES AND ACADEMIES.

THE NEW YORK ACADEMY OF SCIENCES—SECTION OF GEOLOGY AND MINERALOGY.

THE section met on May 15, 1899, Dr. A. A. Julien presiding. The following program was then offered:

1. Arthur Hollick: 'A Reconnoissance of the Elizabeth Islands, Mass.'

2. W. Goold Levison: 'Several Notes on Microscopical Attachments and Photography of Minerals.'

3. Heinrich Ries: 'Preliminary Notes on the Physical Properties of Clays.'

Another paper announced in behalf of Professor J. C. Smock, State Geologist of New Jersey, on 'Artesian Water Supply in New Jersey,' was postponed on account of sickness and absence of the author.

The following is an abstract of Dr. Hollick's paper on the Elizabeth Islands, which was illustrated by specimens, photographs, sketches and charts.

The Elizabeth Islands extend in a southwesterly direction from Wood's Holl, Mass., forming the barrier between Buzzard's Bay, on the north, and Vineyard Sound, on the south.

The principal islands are five in number, and beginning at the eastern end of the group they are known as Naushon, including Nonamessett, Uncatina, Pine Island, Buck Islands and the Weepeckets; Pasque; Nashaweena; Penikese, including Gull Island, and Cuttyhunk.

Little or nothing has been written in regard to them for the reason that each island, with the exception of Cuttyhunk, on which there are a number of separate holdings, belongs to some one individual, family or corporation; hence there is no line of public travel to or through them and no house of public entertainment, except in connection with Cuttyhunk. The trip occupied a week and was made possible through the courtesy and kindness of the owners.

Taken as a whole the islands represent a partially submerged morainal ridge, which has become separated into islands and isolated from the mainland in recent geologic times. They apparently represent a later, more northern branch of the terminal moraine, the southern or older portion of which is represented by Montauk Point, Block Island and Martha's Vineyard.

One of the most interesting discoveries was an exposure of plastic and lignitic clay, presumably Cretaceous in age, on the south side of Nonamessett. The proximity of this locality

to the mainland leads to the inference that other deposits of the same age, which have escaped erosion, may be found farther north, up the old estuaries, where theoretically the formation once extended.

The general surface features of the islands are such as are characteristic of typical morainal regions, consisting of rounded hills and corresponding depressions, many of the latter occupied by ponds or swamps.

To an inquiry by Professor Kemp, Dr. Hollick stated that only indefinite lignitic remains had been detected in the deposits, and that no ilmenite boulders had been recognized. The Chairman explained that the *Pinus rigida*, of sparse occurrence on Naushon, was the prevailing conifer along the south shore of Cape Cod to the eastward, while, on the other hand, the beech was rarely found on the Cape. The morainic chain of the Elizabeth Islands extended to the northerly part of the Cape, in Brewster, separated from the south shore by modified glacial deposits in Dennis, Harwich and Chatham.

Professor R. E. Dodge was inclined to believe that the whole aspect of the topography of these islands was that of a drowned shore line, modified by subsequent erosive action, probably not caused by easterly winds. Professor J. F. Kemp favored the view of the author, that present erosive action was mainly concerned; and Dr. Hollick pointed out that the prevailing direction of the wind was southeast, that extremely violent currents prevailed in the channels, especially during ebb-tides, that sandspits occurred only at the east end of the channels, and that, during the process of sinking and erosion, the embayments deepened, met and united, and thus the channels were cut through.

Professor Levison exhibited by the lantern six photographs of minerals, natrolite and calcite, taken by reflected light; four enlargements of photomicrographs, by reflected light, of minute groups of aragonite, pyrite, apophyllite and stilbite; a new method of showing the photographic action of the Becquerel rays on a sensitive plate, by use of a written inscription on a card, in the form of a glue-line dusted with the powdered uraninite; a simple mode of attachment of a separate foot to a microscope, in order to render it portable; and read a note on a visit to Hubbard's Mine, Fairfield county, Connecticut, with description and analysis of apparently a new lithia mineral from that locality. The Chairman suggested that such photographic enlargements might be of great service for study of faces and even goniometric determinations on very minute crystals, where numbers of such crystals were arranged in coincident planes and proper adjustments could be made.

In the absence of Dr. Ries, an abstract of his paper was presented by Professor Kemp, with emphasis on two important conclusions: First, that the plasticity of clays was not caused by the predominance of any particular constituent, such as Kaolin, but by the physical coherence of minute surfaces; secondly, that the fusibility of clays was due, not so much to their mineral components, but to their ultimate chemical composition, and that this could be, therefore, practically improved, when necessary, by intermixture with the proper constituents.

The Academy then adjourned to October 2, 1899.

ALEXIS A. JULIEN,
Secretary of Section.

TORREY BOTANICAL CLUB, MAY 9, 1899.

THE regular program of the evening consisted of an address by Mr. Samuel Henshaw, 'Notes on the Flora of Porto Rico,' giving an account of the people, customs, climate and present conditions of that island. He exhibited numerous specimens of Porto Rican utensils and articles of household use of vegetable manufacture, including many applications of the calabash gourd, from spoons to chopping-bowls, many ways of using palm leaves, etc., etc. He referred to the immense growths of *Bougainvillea*, showing a specimen, of Crotons in the open sun, of *Fourcroya*, *Lantana*, etc. He showed many photographs, portions of large tree fern and banana trunks, a tall wooden mortar and dumbbell-shaped wooden pestle, musical instruments made from gourds and from other sources. Orchids were few, the reports of their occurrence proving to be founded chiefly on aroids and *Tradescantias*. By one coming from the North the most singular sen-

sation is experienced on finding every common weed under foot to be what would have been a greenhouse plant at home. But he heard our soldiers say: "We would rather go out and pick a dandelion once more."

EDWARD S. BURGESS,
Secretary.

THE NEW YORK SECTION OF THE AMERICAN CHEMICAL SOCIETY.

THE May meeting of the New York Section of the American Chemical Society was held on the 5th at the Chemists' Club, 108 West Fifty-fifth Street.

Mr. A. H. Allen, of Sheffield, England, well known as the author of the 'Commercial Organic Analysis,' was present as the Society's guest and was warmly welcomed. In response he made a short address expressing keen appreciation of his reception by the Section and his pleasure of being able to attend this meeting.

The papers of the evening were by:

1. W. S. Myers: 'On the Alcoholic Content of Some Temperance Drinks.'

2. J. H. Stebbins: 'Upon the Action of Diazo Compounds upon Thymol para-sulpho-Acids.'

3. J. H. Stebbins: 'Note upon the Reichert Figure of Butter.'

4. L. L. Van Slyke, Geneva, N. Y.: 'Some Facts and Fictions about Milk.'

5. Martin L. Griffin, Mechanicsville, N. Y.: 'Comparative Value of certain Reagents for removing Lime and Magnesia from Natural Waters for Industrial Uses.'

6. Charles F. McKenna: 'A New Laboratory Valve.'

DURAND WOODMAN,
Secretary.

DISCUSSION AND CORRESPONDENCE.

LARVAL STAGE OF THE EEL.

TO THE EDITOR OF SCIENCE: Mr. Eugene Blackford's 'Note on the Spawning Season of the Eel' in SCIENCE (p. 741–742) is interesting as well as important. As Mr. Blackford has indicated, almost "the only known instance of the taking of a sexually matured eel has been in waters of [nearly] one hundred or more fathoms in depth." Others are rare. It is probable, however, that our east-coast eels generally spawn in water of less depth. The occurrence of an eel with well-developed eggs in water only two or three fathoms deep in May is, however, truly exceptional. The question then arises whether the eel had matured eggs 'many months later than in the Mediterranean' or earlier. I am disposed to believe that the individual noticed had wandered beyond its breeding ground and abnormally retained its eggs on account of its uncongenial environment. As Mr. Blackford also remarks about New York, "it has always been supposed that the spawning season takes place within a month or so of the" descent of the eels in November and December, and that 'the elvers (*montées*) which ascend the rivers' in the next ensuing 'early spring' are the young of those that had entered the sea a few months before. For a long time I have been of a different opinion. Inasmuch as (1) the sea-going eels do not mature their ova till the winter season, (2) the leptocephalus young are found from February to September, or later, and (3) the transitional form between the leptocephalus stage and the cylindrical stage has been found in January, it appears tolerably certain that the elvers which ascend the rivers in the early spring are the progeny of eels that descended therefrom *not later* than winter of the *penultimate* (and not last) year before.

It may be of interest to add that brief notices and figures have been published of the development of the eel in a readily accessible journal—*Nature*—for March 18, 1897 (Vol. 55, pp. 467–468), and for May 27, 1897 (Vol. 56, p. 85).

THEO. GILL.

WASHINGTON, May 26, 1899.

SCIENTIFIC NOTES AND NEWS.

AT a general meeting of the members of the Royal Institution of Great Britain on May 22d the following scientific men were elected honorary members in commemoration of the centenary of the Institution, which is being celebrated this week: Professor S. Arrhenius, (Stockholm), Professor C. Barus (Brown University), Professor H. Becquerel (Paris), Professor G. L. Ciamician (Bologna), Professor N. Egorof (St. Petersburg), Professor A. P. N.

Franchimont (Leiden), Professor A. E. Gautier (Paris), Professor H. G. Kayser (Bonn), Professor W. Korner (Milan), Mr. S. P. Langley (Washington), Professor G. Van der Mensbrugghe (Ghent), Professor A. A. Michelson (Chicago), Professor H. Moissan (Paris), Professor R. Nasini (Padua), Professor W. Nernst (Göttingen), Professor W. Ostwald (Leipzig), Dr. E. Solvay (Brussels), Professor R. H. Thurston (Cornell), Professor E. Villari (Naples), Professor J. L. G. Vielle (Paris), Dr. E. Ador (Geneva), Dr. L. Bleekrode (The Hague), Professor J. S. Ames (John Hopkins University), Professor G. F. Barker (University of Pennsylvania), Geheimrath Professor Dr. Liebreich (Berlin), and President W. L. Wilson (Washington and Lee University).

As part of the exercises of the jubilee of Professor Stokes, Cambridge University has conferred the degree of Doctor of Science on the following delegates: Albert Abraham Michelson, professor of experimental physics in the University of Chicago; Marie Alfred Cornu, member of the Institute of France, professor of experimental physics in the École Polytechnique of Paris; Jean Gaston Darboux, member of the Institute of France, professor of higher geometry in the University of Paris; Friedrich Wilhelm Georg Kohlrausch, member of the Academy of Sciences of Berlin, Director of the Physikalisch-technische Reichsanstalt, Charlottenburg; Magnus Gustaf Mittag-Leffler, professor of pure mathematics at Stockholm; Georg Hermann Quincke, professor of experimental physics in the University of Heidelberg; Woldemar Voigt, professor of mathematical physics in the University of Göttingen.

THE President of the Dover meeting of the British Association will as we have already announced, be Professor Michael Foster. The Presidents of the various Sections are to be: Mathematical and Physical Science, Professor J. H. Poynting; Chemistry, Mr. Horace T. Brown; Geology, Sir Archibald Geikie; Zoology, Mr. Adam Sedgwick; Geography, Sir John Murray; Economical Science, Mr. Henry Higgs; Mechanical Science, Sir William White; Anthropology, Mr. C. H. Read; Physiology, Mr. J. N. Langley; Botany, Sir George King. The local committee have already collected £1,500 toward the expenses of the meeting.

THE honors conferred by Queen Victoria on her eightieth birthday included a baronetcy for Professor J. S. Burdon-Sanderson, the well-known physiologist, regius professor of medicine at Oxford University, and the K. C. B. for Professor Michael Foster, professor of physiology at Cambridge University, and to Mr. W. H. Preece, President of the Institution of Civil Engineers.

PROFESSORS WILLIAM JAMES (philosophy), J. E. Wollf (petrography and mineralogy) and W. F. Osgood (mathematics), of Harvard University, will be abroad on a leave of absence next year. Dr. Dickinson S. Miller will take the work of Professor James, and Professor James Pierpont, of Yale University, the work of Professor Osgood.

PROFESSOR S. P. THOMPSON, F.R.S., has been nominated for the presidency of the British Institution of Electrical Engineers.

WE learn from *Nature* that at the last meeting of the Midland Malacological Society, held in Mason University College, Birmingham, on May 12th, Mr. H. A. Pillsbury, of Philadelphia, and Mr. Henry Fischer, of Paris, were elected honorary members.

THE gold medal of the Paris Geographical Society has been presented to General Galliéni.

PROFESSOR C. JUDSON HERRICK, who holds the chair of biology in Denison University, has received the Cartwright Prize ($500) of the College of Physicians and Surgeons, Columbia University.

MR. JOHN S. LORD, of Springfield, Ill., has been appointed Chief of Division in the Department of Statistics of the Census Bureau. Mr. Lord has been Chief of the Illinois State Labor Bureau and held a position in the Eleventh Census.

DR. WILLIAM Z. RIPLEY, of the Massachusetts Institute of Technology and Columbia University, has been elected a corresponding member of the Società Romana di Antropologia.

EFFORTS are being made to collect £5,000 to erect a monument on the spot in Africa where Livingstone died.

MISS ELIZABETH M. BARDWELL, professor of

astronomy in Mount Holyoke College, died on May 28th at the age of 67 years.

Mr. G. F. Lyster, a well-known English engineer, has died at the age of 76 years.

The British Association will, at its Dover meeting, not only exchange visits with the French Association, but will also entertain the Belgian Geological Society.

The United States Weather Bureau, which was opened at Colon, Colombia, last September, has finally been closed, its site being out of the track of the hurricanes. The instruments are to be transferred to Jamaica.

King Humbert opened at Como on May 20th the International Electrical Exhibition organized to celebrate the centenary of Volta.

The Biological Survey of the Department of Agriculture has sent Mr. W. H. Osgood and Mr. L. B. Bishop to study the geographical distribution of animals in Alaska.

The scientific expedition visiting Alaska on the invitation of Mr. Edward H. Harriman, to which we have already called attention, left Seattle on May 31st. It is expected that the expedition will return about August 1st.

The Entomological Society of Albany has recently been organized with an initial membership of about twenty, under the following officers: Dr. E. P. Felt, President; Professor Charles S. Gager, Vice-President; Mr. Charles S. Banks, Recording Secretary; Miss Margaret F. Boynton, Corresponding Secretary; Professor H. M. Pollock, Treasurer. The headquarters of the Society will be, for the present, at the office of Dr. Felt, the State Entomologist, where the regular meetings will be held the second Friday in each month. The objects of the organization are the promotion of interest in entomological seience and the furtherance of fellowship, among those interested, for their mutual benefit and enjoyment.

The Institution of Civil Engineers, London, is holding a conference during the present week. According to the program Mr. W. H. Preece, the President, makes an address, and various engineering subjects will be taken up in seven sections. The subjects for discussion range over the whole field of engineering service and practice, and include railways, harbors docks, canals, machinery, shipbuilding, mining and metallurgy, water works, gas works, sewerage and electricity. It is proposed that each subject be introduced by a short paper, to be read by the author and discussed by the meeting.

Nature states, in reference to the scientific commission which was appointed a short time ago by the Colonial Office and the Royal Society to investigate the mode of dissemination of malaria, with a view to devising means of preventing the terrible mortality which now takes place among Europeans resident in tropical and subtropical climates, that Dr. Patrick Manson, chief medical adviser to the Colonial Office, has made a statement to a representative of the Exchange Telephone Company. Dr. Manson states that Dr. C. W. Daniels, of the Colonial Medical Service, British Guiana (who first proceeded to Calcutta to familiarize himself with the work which had been carried on by Surgeon-Major Ross for determining the relation of mosquitoes to the dissemination of malaria), has now arrived at Blantyre, in the Central African Protectorate, where he has been joined by Dr. J. W. W. Stephens and Dr. R. S. Christophers. At Blantyre all the resources of the Protectorate will be placed at the disposal of the commissioners, who, before their return to London, will probably pay a visit to the west coast of Africa.

The State Board of Health of Pennsylvania has passed resolutions in view of the attempt of the Health Department of Philadelphia to conceal the presence of contagious diseases in that city. As the matter is one of scientific importance from several points of view, we quote the resolutions:

Resolved, That the State Board of Health and Vital Statistics earnestly deprecates the declared intention of the Director of Public Safety of the city of Philadelphia to conceal the presence and number of cases of smallpox, or any other communicable disease in that city, and for the following reasons:

First. Attempts of this kind invariably end disastrously, defeating their own object. Rumor always magnifies danger, creating suspicion, anxiety and panic. The publication of the exact truth indicates that the authorities are vigilant, possessing full

knowledge of the facts of the case, and have control of the situation, thus engendering a sense of security and dispelling alarm.

Second. The policy of concealment prevents those living in the immediate neighborhood of infected houses, or who may desire to visit such neighborhoods, from taking necessary precautions for their own protection, and in this way facilitates the spread of the infection.

Third. This course would vitiate the vital statistics of the city and State, impairing their accuracy and value, and destroying the confidence of the national health authorities and of those of other States and cities in the trustworthiness of our returns. The latter will, therefore, hesitate to advise their citizens to visit a community which adopts the ostrich-like policy of burying its head in the sand in the presence of a danger, instead of frankly acknowledging and bravely facing it.

Resolved, That the Board, however, desires to express its belief that the danger at present existing is not of a character to excite serious apprehension, its entire confidence in the ability and intelligence of the Health Department of the city, and its assurance that the efficient measures which have been inaugurated will speedily terminate this merely localized outbreak.

ACCORDING to the London *Times* the committee which is organizing the German Antarctic expedition has decided that the expedition is to be composed of one ship only, any possible disadvantages being compensated for by greater independence and mobility. The vessel is to be built entirely of wood. The committee are confirmed in this decision by Nansen's experience with the *Fram*, and by their desire to eliminate all possible causes of error in their magnetic observations. The ship is to be laid down this autumn, and the expedition is to be ready to start in the autumn of 1901. It is to be away two years altogether. After touching at the Cape the expedition is to make for the Antarctic Continent south of the Kerguelen Islands, and there establish a scientific station at some point suitable for wintering. A pack of Siberian dogs is to be taken, and dashes will be made on sledges towards the South Pole and the south magnetic pole. Meteorological observations will also be made from a captive balloon. After the breaking-up of their winter quarters the expedition will attempt to make as complete a survey as possible of the coast line of the Antarctic Continent. The leader of the expedition is to be Dr. von Drygalski, who conducted the German exploration of Greenland in the years 1891–93. The committee expresses great satisfaction that the English Antarctic expedition has at last been definitely decided on, and points out that the value of the two sets of meteorological observations will be greatly enhanced by their being carried on simultaneously. According to their information, the English expedition is to make the attempt to penetrate southward from the South Pacific. The meeting of the International Geographical Congress in Berlin in October will give an opportunity for deciding on the details of the scheme of cooperation.

OWING to the public improvements in the neighborhood of Parliament-street the Royal Meteorological Society has been obliged to vacate its offices in Great George-street, and find accommodation elsewhere. The Council ultimately took rooms at Prince's Mansions, 10, Victoria Street, which have been fitted up to meet the requirements of the Society. On the evening of May 16th the President, Mr. F. C. Bayard, held an 'at home' in these new rooms, which was largely attended by the Fellows. An exhibition of instruments, photographs, etc., was arranged in the various rooms, and there were also several demonstrations by the lantern.

A BLUE book has been issued by the British government, giving a report prepared by Professors Thorpe and Oliver and Dr. Cunningham on the use of phosphorus in lucifer matches. According to an abstract in *Nature* Professor Thorpe deals with the questions from the chemical standpoint, and enters into such matters as the differences between the allotropic forms of phosphorus, the composition of phosphorus fumes, their solvent action on teeth, and the composition of the various pastes, etc., used in the manufacture of matches. Full and illustrated accounts of the process of manufacture are given, both in Great Britain and in other countries, and the precautions taken to minimize the danger of the workpeople. Dr. Oliver, whose work in connection with other dangerous trades is so well known, approaches the question from the medical standpoint, and

the portion of the report for which he is responsible is clear, concise and practical. Dr. Cunningham's report contains a full account of phosphorus necrosis, and is illustrated by diagrams showing various stages of the diseases in the teeth and jaws. This condition is the most frequent and most obvious of the poisonous effects of the phosphorus; it is not by any means the only one. He also gives in full the precautions which should be adopted in all factories for combating the injurious effects of the poisonous fumes. There are various appendices which give in detail the facts upon which the main body of the report is founded. In the match industry two forms of phosphorus are used: *yellow phosphorus*, which is highly poisonous, and gives off poisonous fumes which consist mainly of low oxides of phosphorus; and *red phosphorus*, which does not fume, and is hardly poisonous even if swallowed. Then, as is well known, there are two principal varieties of matches used: 'safety matches,' which are tipped with a composition free from phosphorus; the surface on which they strike is covered with a composition of which red phosphorus forms a part. The 'strike anywhere' matches are tipped with a paste containing yellow phosphorus in a proportion which varies from 3 to 30 per cent. It is in the making of such matches only that danger arises. In regard to them the commission reports: "So far as the home consumption is concerned, it does not seem that the prohibition of the use of yellow phosphorus would involve any serious hardship, and this course has already been adopted by Denmark, and decided upon by Switzerland, care being taken at the same time to prohibit the use or importation of yellow phosphorus matches. But neither of these countries has or had any export trade to lose. The United Kingdom, Belgium, Sweden and Japan manufacture largely for export, and it is feared that immediate prohibition of yellow phosphorus would at once divert that portion of our trade to other countries, unless international agreement upon the subject was arrived at. If grave injury to the health of the workpeople were inevitable the loss of the trade might well be regarded as the smaller sacrifice of the two, but the result of the inquiry points to a different conclusion. With due selection of workpeople, strict medical and dental supervision, proper structural and administrative conditions, and substitution of machinery for hand labor, it seems that the dangers hitherto attending the use of yellow phosphorus can be overcome."

UNIVERSITY AND EDUCATIONAL NEWS.

Mrs. Jane L. Stanford has executed deads conveying to Stanford University the greater part of her property.

Washington University has received a further gift of $150,000 from Mr. Samuel Cupples for the support of the department of Civil, Mechanical and Electrical Engineering and Architecture for five years, and a dormitory to cost $100,000 from Mrs. John E. Liggett, in memory of her late husband.

Mr. Andrew Carnegie has given $50,000 to the Stevens Institute, Hoboken, for the erection of an engineering laboratory.

The quarter of a million pounds required to inaugurate the University of Birmingham has been collected. The anonymous donor who has already subscribed liberally towards the fund has offered to give £12,500 if the total amount be raised to £300,000.

Mount Holyoke College has received a gift of $10,000 from James Talcott, of New York, to complete the botanical gardens and plant-houses which are now under way at the institution.

A College of Comparative Medicine is about to be established at Harvard University. A chair of comparative pathology has been endowed by the fund given by Mr. George Fabian, and appropriations have been made from the bequest of the late Henry L. Pierce for a chair of comparative physiology and for laboratories. It is intended that the college shall perform the functions of the Pasteur Institute, of Paris, and the Jenner Institute, of London.

The Rev. W. H. P. Faunce, pastor of the Fifth Avenue Baptist Church, New York City, has been elected President of Brown University.

Professor Henry G. Jesup, who has held the chair of botany at Dartmouth College for twenty-two years, has resigned.